

In the Claims:

Please amend the claims so as to read as follows:

1. (Currently Amended) A rising and moving apparatus, comprising:

a body;

a an elastically deformable wing portion elastically deformed by force

exerted by surrounding fluid, to an extent that allows a body to hover and move associated with said body;

a driving unit for driving the wing portion; and

a control unit controlling the manner of driving the wing portion by the driving unit, wherein

when driven by said driving unit said wing portion is elastically deformed

by a surrounding fluid such that a lifting force is generated on said wing portion that

causes said apparatus to rise, and said control unit controls the extent to which said

apparatus rises in said surrounding fluid and also whether said apparatus hovers or moves

in said surrounding fluid.

2. (Currently Amended) The rising and moving apparatus according to claim 1,

wherein

said wing portion has an upper side and a lower side, said upper

side having a greater torsional rigidity or flexural rigidity of an upstream

side of the fluid higher than the a torsional rigidity or flexural rigidity of

the downstream said lower side of the fluid.

3. (Currently Amended) The rising and moving apparatus according to claim 1,

wherein

said wing portion has a leading edge and a trailing edge, said

leading edge having a greater torsional rigidity or flexural rigidity on the

side of a leading edge higher than the a torsional rigidity or flexural

rigidity on the side of a of said trailing edge.

4. (Currently Amended) The rising and moving apparatus according to claim 1,

wherein

said wing portion has an upper surface and extends outwardly
from said body in a span direction, said upper surface of said wing
portion defining a wave plate structure having comprising alternating
ridge lines ~~or~~ and valley lines extending along said span direction of the
wing portion is provided at an upstream side of the fluid at the wing.

5. (Currently Amended) The rising and moving apparatus according to claim 1,

wherein

said wing portion includes a leading edge portion and extends
outwardly from said body in a span direction, said leading edge portion
defining a wave plate structure having comprising alternating ridge lines
~~or~~ and valley lines extending along said span direction of the wings;
portion is provided at a leading edge portion of the wing.

6. (Currently Amended) The rising and moving apparatus according to claim 1,

wherein

said wing portion includes an upper side portion comprising a
self-supporting member or a non-self-supporting member and an
associated support structure, and a lower side portion comprising a self-
supporting member or a non-self-supporting member and an associated
support structure, and a thickness of the upper side portion of said wing
portion on the upstream side of the fluid is larger than the a thickness of
the lower side portion of said wing portion on the downstream side of the
fluid, or a supporting structure of the wing portion at the upstream side of
the fluid is thicker than the support structure at the downstream side of
the fluid.

7. (Currently Amended) The rising and moving apparatus according to claim 1,
wherein

said wing portion includes a front side portion comprising a self-supporting portion or a non-self-supporting portion and an associated support structure and a trailing side portion comprising a self-supporting portion or a non-self-supporting portion and an associated support structure, and a thickness of the front side portion of said wing portion on the upstream side of the fluid is larger than the a thickness of the trailing side portion of said wing portion thickness of said wing portion on the side of a leading edge is larger than the thickness on the side of a trailing edge, or a support structure of said wing portion on the side of the leading edge is thicker than the support structure on the side of the trailing edge.

8. (Currently Amended) The rising and moving apparatus according to claim 1,
wherein

said wing portion defines a first section adjacent to which a relative velocity of said surrounding fluid is high and a second section adjacent to which a relative velocity of said fluid is low, and an angle of attack of said first section of said wing portion to said surrounding fluid where fluid velocity is relatively high is smaller than the an angle of attack to said surrounding fluid of said second section of said wing portion where the fluid velocity is relatively low.

9. (Currently Amended) The rising and moving apparatus according to claim 1,
wherein

said wing portion defines a tip end furthest from said body and a root substantially abutting said body, and an angle of attack to said fluid of said wing portion at a said tip end is smaller than the an angle of attack to said fluid of said wing portion at a said root.

10. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

said wing portion is rotatable about a prescribed center of rotation, and a flexural rigidity of a portion relatively of a first section of said wing portion closer to center of rotation is higher greater than a flexural rigidity of a portion second section of said wing portion disposed further away from said prescribed center of rotation than said first section of said wing portion relatively far from the center of rotation.

11. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

said wing portion is rotatable about a prescribed center of rotation, said wing portion comprises a self-supporting member or a non-self-supporting member and a support structure, and a thickness of said wing portion at a portion first section thereof closer to is greater than a thickness of a second section of said wing portion disposed further from said prescribed center of rotation than said first section of said wing portion is larger than the thickness far from said center of rotation, or a support structure closer to said center of rotation is thicker than the support structure far from said center of rotation.

12. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

said wing portion is rotatable about a prescribed center of rotation and defines a first section and a second section, said second section being located further from said center of rotation than said first section, and a torsional rigidity of said first section a portion relatively closer to the center of rotation is higher greater than the a torsional rigidity of said second section a portion relatively far from the center of rotation.

13. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

said wing portion defines a leading edge, a trailing edge, a span direction extending outwardly from said body and an is provided such that the axis of rotation located along said span direction of the wing portion such that said axis of rotation is positioned approximately in the middle midway between the leading edge and the trailing edge of the wing portion.

14. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

~~during a stroke reversal of said wing, said wing portion has a~~
lower surface, said control unit controls said driving unit such that said wing portion pivots upwardly and downwardly relative to said body in upward and downward strokes and during transitions between said upward and downward strokes said lower surface of said wing comes into contact with an upper portion of a vortex generated by the flapping motion of said wing portion immediately before said transitions the
~~stroke reversal~~

15. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

~~during a stroke reversal of said wing, said wing portion defines a~~
curved upper surface having a first center of curvature and a curved
lower surface having a second center of curvature, and said control unit
controls said driving unit such that said wing portion pivots upwardly
and downwardly relative to said body in upward and downward strokes
such that elastic deformation of said wing portion occurs so in a manner
such that a direction of extension of an axis of rotation of a vortex
generated by the stroke reversal during transitions between upward and
downward strokes of said wing portion substantially matches a matches
direction of extension of an axis connecting the centers of radii of
curvature of said upper and lower surfaces of said wing portion.

16. (Currently Amended) The rising and moving apparatus according to claim 1, wherein

said wing portion defines a root portion substantially adjacent to said body, and
when said wing portion is driven by said driving unit, a said root portion moves
upwardly and downwardly relative to said body periodically, and said wing
portion elastically deforms such that said wing portion defines sections has a
portion having a different phase of periodic motion than the phase of the periodic
motion at the root portion. that move upwardly and downwardly relative to said
body out of phase with the movement of said root portion.

17. (Currently Amended) The rising and moving apparatus according to claim 16, wherein

said wing portion defines an outer tip and said wing portion elastically deforms such that a phase of motion of a portion sections located closer to said tip than said body where a relatively large fluid force is exerted is delayed ~~from~~ relative to a phase of motion of sections of said wing portion closer to said body a portion where a relatively small fluid force is exerted.

18. (Currently Amended) The rising and moving apparatus according to claim 17, wherein

said delay in phase is at most 1/2 of one period of said ~~flapping~~
upward and downward motion of said section of said wing portion closer to said tip.

19. (Currently Amended) The rising and moving apparatus according to claim 16, wherein

said wing portion elastically deforms such that a phase of the upward and downward motion of a tip end portion is delayed ~~from~~ relative to a phase of the upward and downward motion of a root portion of said wing portion..

20. (Currently Amended) The rising and moving apparatus according to claim 19, wherein

said delay in phase is at most 1/2 of one period of said ~~flapping~~
upward and downward motion of said root of said wing portion.

21. (Currently Amended) The rising and moving apparatus according to claim 1, wherein
a manner of control of said control unit controlling said driving unit and a manner of elastic deformation of said wing portion are related such that a prescribed parameter ~~related to flapping rise and~~ of movement of said wing portion has the optimal value in accordance with a result of fluid-structure interactive analysis.
22. (Currently Amended) The rising and moving apparatus according to claim 21, wherein
the prescribed parameter related to ~~flapping rise and~~ movement of said wing portion may be lift force generated by the flapping upward and downward motion of said wing portion relative to said body.
23. (Currently Amended) The rising and moving apparatus according to claim 21, wherein
the prescribed parameter related to ~~flapping rise and~~ movement of said wing portion is a value obtained by dividing a lift force generated by the ~~flapping~~ motion of said wing portion by a torque necessary for driving said wing portion so as to generate the a desired lift force.
24. (Currently Amended) The rising and moving apparatus according to claim 21, wherein
the prescribed parameter related to ~~the flapping rise and~~ movement of said wing portion is the highest frequency of said driving unit necessary for realizing said flapping optimum upward and downward motion of said wing portion.

25. (Current Amended) The rising and moving apparatus according to claim 21, wherein
the prescribed parameter related to the ~~flapping rise~~
movement of said wing portion is a value obtained by dividing
the lift force generated by the ~~flapping upward and downward~~
motion of said wing portion by an energy necessary for
generating the desired lift force.
26. The rising and moving apparatus according to claim 1, wherein
said wing portion satisfies the following relation, where f denotes flapping
frequency, L denotes representative length, r denotes a distance from a portion having
the highest stiffness, w denotes a load on a portion at a distance r from the portion having
the highest stiffness, and d denotes a displacement generated at the portion that bears the
load w exerted by the load w:
- $$0.36 \times 10^{-8} < r^3 \times w/d/(L \times f)^2 < 4.48 \times 10^{-8}.$$
27. The rising and moving apparatus according to claim 1, wherein
said wing portion has Young's modulus of 1.77×10^8 to 5.66×10^9 .
28. The rising and moving apparatus according to claim 1, wherein
said wing portion has Young's modulus of 2.5×10^8 to 2.0×10^9 .
29. The rising and moving apparatus according to claim 1, wherein
said wing portion has Young's modulus of 1.77×10^8 to 2.0×10^9 .

30. (Currently Amended) The rising and moving apparatus according to
claim 1, wherein

said wing portion has an outer tip end portion and a root portion
substantially adjacent to said body portion, and stiffness of a prescribed
portion of said wing portion gradually increases from said tip end portion
of said wing portion to said root portion of said wing portion, in
proportion to a square of a distance from the tip end portion of said wing
portion to said prescribed portion.

31. Withdrawn

32. Withdrawn

33. Withdrawn

34. Withdrawn

35. Withdrawn

36. (New) A rising and moving apparatus, comprising:

- a body;
- an elastically deformable wing portion associated with said body;
- a driving unit for driving the wing portion; and
- a control unit controlling the manner of driving the wing portion by the driving unit, wherein said control unit reciprocates said wing portion along a plane perpendicular to a direction of lift force generated by a flapping motion thereof for hovering and drives said wing portion in a different manner from a driving manner for hovering for moving said apparatus in a horizontal direction.

37. (New) A rising and moving apparatus, comprising:

- a body;
- an elastically deformable wing portion associated with said body;
- a driving unit for driving the wing portion; and
- a control unit controlling the manner of driving the wing portion by the driving unit, wherein a lift force is generated on the wing portion of said rising and moving apparatus by elastic deformation of the wing portion.